Slideshow

FULL DETAILS AND TRANSCRIPT

Using Multiple Representations to Teach Fractions

Mountain Ridge Middle School and Northridge Elementary School, Colorado • May 2008

Topic: National Math Panel: Critical Foundations for Algebra
Practice: Mathematics Preparation for Algebra

Highlights

- Building on students' early intuitive understanding of fractions
- Using different types of materials: example of using unifex cubes to represent fractional units
- How familiar materials (egg cartons) are used differently across the grades, moving from understanding parts of the whole to mixed fractions and computation
- Games and use of virtual fractions via technology

About the Sites

Mountain Ridge Middle School
Highlands Ranch, CO

Demographics
83% White
7% Hispanic

7% Asian
2% Black
1% Native American
3% Free or Reduced-Price Lunch

Douglas County Schools have developed K-12 Essential Learnings to focus on the most important "checkpoints" and to ensure that students are mastering key topics and skills. Mountain Ridge Middle School illustrates the results with:

- Essential Learnings;
- Understanding algebra as the generalization of arithmetic;
- Use of weekly data review and strategy sharing to build a culture of mathematics;
- Coaching of principal, by math supervisor, to observe the mathematics classroom;
- Separate grades on effort and content knowledge in reports to parents; and
- Responsibility placed on students, for reporting to parents, through student-led conferences.

Northridge Elementary School
Highlands Ranch, CO

Demographics
77% White
10% Asian
10% Hispanic
2% Black
6% Free or Reduced-Price Lunch

Douglas County Schools have developed K-12 Essential Learnings to focus on the most important "checkpoints" and ensure that students are mastering key topics and skills. The elementary school demonstrates these features:

- Understanding algebra as the generalization of arithmetic; and
- Using manipulatives and visual representations to teach conceptual understanding of fractions.

Full Transcript

Presentation Title: Using Multiple Representations to Teach Fractions

Mountain Ridge Middle School, Northridge Elementary School, Highlands Ranch, Colorado

Through the use of multiple representations, including manipulatives and technology, teachers at Northridge Elementary School and Mountain Ridge Middle School provide numerous learning situations to help students develop conceptual understanding and fluency of fractions.

Slide 1: District Leadership and Support

Slide text: Mathematics instruction is supported and given focus at the district level. Mathematics Coordinator, Dr. Larry Linnen, works with administrators and teachers at Mountain Ridge Middle School and Northridge Elementary School on using multiple representations to help students develop conceptual understanding of fractions. With this level of district support and coherence, teachers know that instruction and curriculum are aligned across grade levels.

Larry Linnen talks about conceptual understandings of fractions.

Audio: One of the keys to fractions is that kids understand fractions conceptually. One of the best ways to get at conceptual understandings of fractions is to have kids look at multiple representations of fractions—different ideas, sketches, diagrams. What do fractions look like in the real world? Fractions on a number line is one way to think about it, but what does a fraction actually look like?

Slide 2: Early Understanding of Fractions

Slide text: Many students enter elementary school with an intuitive sense of fractions, based on personal experiences. Students use what they already know to develop new understanding. Teachers help students expand their grasp of fractions through multiple examples and representations to develop conceptual understanding and fluency.

Fifth-grade teacher, Christine Livingston, talks about building on children's intuitive understanding of fractions.

Audio: I believe children, they are familiar with ideas of fractions even before they start school. They may even intuitively understand some simple fractions, for example, half of a pie, third of a cup of milk. However, they do not understand fully the meaning of fractions, and it's important for them to understand, both visually and cognitively, what a fraction is and how it can be used in mathematics.

Slide 3: Primary Grades Explore a Hard Concept

Slide text: Students use different types of materials, such as unifix cubes, to develop an understanding of fractions—such as parts of a whole or placement of fractions on the number line. As an example, students might construct a "unit segment" made up of six unifix cubes connected together. Thinking about the segment as the length between successive whole numbers, each unifix cube represents a fraction of the unit segment—in this example, 1/6. Extending to an equivalent fraction, two cubes represent a 1/3 segment.

Second and third-grade teacher, Cathleen Brooks, explains.

Audio: A hard concept for kids to understand is, "What is a third?" and you give them a pile, or one-third of this group. It's easy when they learn in kindergarten: if there's only three, you take one. But when there are six items, how do you pull out one-third of that? So we pull out the six cubes, or whatever they are, and we tell them to make groups of three and take one from each group. So they physically move them and can see, "How many do you have?" Because it's a very—especially in the primary grades, when you start mixing your equivalent fractions, the hands-on and the modeling over and over help them to understand it. So we truly do a lot of unifix cubes and coins or any kind of object that you have that you can pull 18 and then, "Now show me a fourth of them."

Slide 4: Fun with Fraction Circles

Slide text: Students use fraction circles to compare and contrast fractions. They place different fraction pieces on top of each other, making connections between the number of different fractional parts that cover the same area, which makes them "equivalent." The students then create pictures of the comparison, which helps in developing understanding of equivalent fractions—such as 4/12, 2/6, and 1/3—in a fun way.

Third-grade teacher, Stacey Golenski, talks about fraction circles.

Audio: I just used fraction circles today to teach comparing fractions and equivalent fractions as well. So we would model using the fraction circles, two-eighths, and then also model one-fourth. And then we would decide, "Okay, which one is larger?" and "Are they equivalent?" and "What does that mean?" And they were actually able to put equivalent fractions over the top of the other one, so they're actually able to see. So, sometimes my students were even getting into adding fractions and coming up with other combinations, so they were taking it a step further. It was interesting to watch them: "Well, no, that's not exactly the same thing as one-half." They were excited and having fun. That's an important part of learning.

Slide 5: Understanding with Familiar Fractions

Slide text: Using students' familiarity with certain types of fractions provides teachers the opportunity to build on this prior knowledge to help students develop a deeper understanding of fractional parts and

equivalence. In this case, teachers use "Egg Carton Math," which uses a "dozen," or 12, as the unit (whole), allowing students to examine and identify many fractions as part of the whole, such as 4/12 and 6/12.

First-grade teacher, Carol Amsberry, talks about "Egg Carton Math."

Audio: In first grade, many of the students are familiar with the term "dozen." So, I've used a dozen carton, and we have shown half of a dozen, a fourth of a dozen. The students, actually, after much play with the dozen eggs, can add two-fourths of a dozen and one-fourth of a dozen equals three-fourths of a dozen. So, we take a concept that they are familiar with and label it into the fractional parts.

Slide 6: Egg Carton Math in Upper Grades

Slide text: Using the egg carton context, teachers work with students to develop understanding of fractions, including mixed fractions, in the upper elementary grades and operations with fractions in the intermediate and middle grades. Students work with equivalent fractions, such as 6/12 = 1/2 and 4/12 = 1/3; mixed fractions, such as 1 7/12; and computation, such as 1 5/12 and 2 1/3, using familiar materials.

Christine Livingston talks about "Egg Carton Math" and equivalent fractions.

Audio: And we carry through with the—"egg carton math" is what we call it in the intermediate grades, where we chart all the equivalent fractions that you can make, and we show the kids how to use yarn to separate the carton into various fragments or fractions, so the kids can visually see it. They visually manipulate the egg cartons and the little balls that go inside the egg cartons to represent fractional pieces. To add and subtract fractions, you can either multiply and divide fractions in the upper grades with the "egg carton math," which has been a really helpful visual tool for the children.

Slide 7: Games to Reinforce Fraction Concepts

Slide text: Teachers at Northridge Elementary and Mountain Ridge Middle School often use games as one of a number of stations, operating simultaneously within the classroom, to provide students the opportunity to practice and reinforce their understanding of fractions in fun, challenging, and stimulating ways.

Christine Livingston talks about "Baseball Math."

Audio: We also use another game, per se, called "baseball math," in upper grades. "Baseball math" uses a set of a baseball team cards—a set of, I believe, nine cards. There are batting averages, there's averages for runs and hits and walks and such. The children use those numbers and manipulate those numbers into equivalent fractions, decimals, percents. Going into, looking at more so the fraction, but then also interpreting that and enabling them to look at it and see, "Okay, how would that be transformed into a percent? How can we then look at it as a proportion of how many of their 'up-to-bats' did they actually

attain?" And the students really enjoy doing that, and it's real life. It's motivational, and I think a key to a lot of the fractions is making it meaningful to them in a real-life situation.

Slide 8: Using Technology to Understand Fractions

Slide text: There are many ways that technology can be integrated in the classroom. Calculators, computers, graphing, games, and simulations can all be useful in helping students grasp essential concepts and supporting computation skill development. There are a number of fraction games that come with many curricular materials. Students can also access them at a variety of sites on the Internet.

Christine Livingston talks about computer based instructional games.

Audio: A curricular-based program, based on the computer, in which they're able to play games on the computer. Several of the games would be "Frac-tac-toe," where they use fractions, and they rename fractions as percents. There's also a game called "Fraction Top-it," where they play a fraction contest against the computer.

Slide 9: Visual Representation for Understanding

Slide text: For some students, working with fractions as purely abstract representations leads to mistakes and misunderstandings as they try to carry out operations. Teachers in Douglas County schools help students build their conceptual understanding by working through hands-on, minds-on learning situations that support transitions from concrete to abstract.

Christine Livingston talks about using drawing to learn computation.

Audio: By actually, visually drawing a representation of that fraction, the students then will look at the fraction by visually seeing it. Then when they want to go further and add and subtract fractions, it's so much easier for them to do the computation based on the visual aid that they have drawn, to help them better understand what they are doing.